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A Comparative Analytical Study on Gandhaka Ointment Prepared by Two Different Oleaginous Bases – As a Thesis Article

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Abstract

Gandhaka (purified sulphur) is broadly used in Ayurvedic dermatological preparations, particularly in Malahara Kalpana (ointment formulations), due to its well-known antimicrobial and skin-healing properties. Although classical Ayurvedic texts, such as Rasa Shastra and Bhaishajya Kalpana, do not directly mention Gandhaka ointment, Rasatarangini by Acharya Sadanand Sharma describes four discrete methods for preparing Gandhaka Taila (sulphur-infused oil). In this study, the third method was selected to prepare Gandhaka Taila using two different base oils: Tila Taila (sesame oil) and Karanja Taila (Pongamia oil). After the initial preparation, both types of Gandhaka Taila were converted into ointments—GO-TT (Gandhaka Ointment with Tila Taila) and GO-KT (with Karanja Taila)—by including beeswax in a ratio of one-fourth of the total volume. These formulations were then subjected to comprehensive analysis, including organoleptic evaluation, physicochemical testing, microbiological safety assessment, and HPTLC profiling. The results revealed that GO-KT had a significantly higher sulphur content (57.27%) and lower moisture loss on drying (0.09%), suggesting enhanced formulation stability. On the other hand, GO-TT demonstrated superior spreadability and showed more HPTLC spots, indicating better application characteristics and a possibly richer profile of active constituents. Both ointments maintained a pH suitable for topical application and were found to be microbiologically safe for external use. Based on these findings, GO-KT may be more effective in conditions requiring higher sulphur content and long-term stability, while GO-TT may be preferred for its better spreadability and ease of use. Therefore, both formulations can be considered effective for managing skin conditions, such as Dadru Kushtha, each offering specific advantages based on clinical requirements.

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INTRODUCTION

Ayurveda employs three primary therapeutic approaches for disease management: *Anta Parimarjana* (internal therapies), *Bahir Parimarjana* (external therapies), and *Shastra Pranidhana* (surgical interventions). It utilizes a combination of herbs, metals, minerals, and animal products, either individually or in synergy, to create distinct dosage forms with unique compositions and applications. An ointment is a semisolid, greasy

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substance that is applied to the skin to treat or soothe skin conditions like burns, rashes, scrapes, and wounds.

In *Ayurveda,* there is no direct reference to ointment found but it can closely correlate with *Malhara Kalpana* in *Ayurveda. Malahara Kalpana* is a dosage form intended for topical application in *Ayurveda*, similar to ointments in modern medications. As such, there are a few references found regarding *Malahara Kalpana* available in major classical texts of *Ayurveda.*

Originating from the Unani system of medicine, it found a place in the texts of *Ayurveda* around the 17th century AD. The word *Malahara* was adopted in the text, *Yogaratnakara,* from the word *Malahama* or *Marham* originates from the Unani System of Medicine. The word *Malahara* means it removes *Mala* (residues) from *Vrana, Twaka Vikara*, etc. Furthermore, earlier, semi-solid topical preparations were referred to as "*Abhyanjana*" in classical texts.

In general, ointments, creams, gels & pastes can be correlated with *Malahara* because of the similarity in mode of application and their semi-solid consistency. Different *Malahara Kalpanas* are mentioned in *Rasatarangini*, a 20th-century text of *Rasashatra*.

Gandhaka ointment is a type of *Malhara* which is made from *Gandhaka Taila* [1], by using beeswax as a binding agent. Reference to *Gandhaka Taila* is found in Rasa Tarangini. There are various types of *Gandhaka Taila* preparation methods mentioned, but in the present study for preparation *Gandhaka Taila Varti* method was adopted. Here, for comparative study, *Gandhaka Taila* was prepared by using *Tila Taila* (Table 1) & *Karanja Taila* (Table 2).

In other texts of *Rasa shastra, Gandhaka Taila* is named as *Gandhaka Dhruti.*

Gandhaka itself has prime importance in *Rasa Shastra.* Table 3 lists the *Acharya*-wise characteristics of *Gandhaka* and its use in various skin diseases as external or internal mentioned in Table 4.

In *Rasendra Chintamani, Acharya* talked about the external use of *Gandhaka Taila*, and in the textbook of *Rasa-Kamdhenu* indication of *Gandhaka Taila* was mentioned in various skin diseases like *Pama, Vicharchika, Pidika* and *Dadru*. *Karanja* itself has important medicine for various types of skin diseases, and the external application of *Karanja Taila* was also mentioned in *Charak Samhita.*

AIM

- The current study was conducted to compare the analytical parameters of *Gandhaka* ointment prepared by *Tila Taila* and *Karanja Taila.*

OBJECTIVES

- To prepare the *Gandhaka Taila* (Sample – 1) by using *Tila Taila* through the *Varti* method.
- To prepare the *Gandhaka Taila* (Sample – 2) by using *Karanja Taila* through the *Varti* method.
- Preparation of *Gandhaka* ointment.
- Comparison of analytical parameters for both ointment samples.

Table 1. Ingredients of *Gandhaka* ointment prepared by *Tila-Taila* (GO-TT).

S.N.	Drug	Latin Name	Part Used	Quantity
1	Shuddha Gandhaka	Sulphur	Shuddha Gandhaka powder	1 Pala (48 gm)
2	Shunthi	Zingiber officinale	Rhizome	1/16 part (3 gm)
3	Maricha	Piper nigrum	Fruit	
4	Pippali	Piper longum	Fruit	
5	Tila Taila	Sesamum indicum	Oil	Q. S.
6	Bee wax	Pongamia pinnata	Fruit	¼ of Gandhaka Taila

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Table 2. Ingredients of *Gandhaka* ointment prepared by *Karanja-Taila* (GO-KT).

S.N.	Drug	Latin Name	Part Used	Quantity
1	Shuddha Gandhaka	Sulphur	Shuddha Gandhaka powder	1 Pala (48 gm)
2	Shunthi	Zingiber officinale	Rhizome	1/16 part (3 gm)
3	Maricha	Piper nigrum	Fruit	
4	Pippali	Piper longum	Fruit	
5	Karanja Taila	Pongamia pinnata	Oil	Q. S.
6	Bee wax	Pongamia pinnata	Fruit	¼ of Gandhaka Taila

Table 3. Properties of *Gandhaka* (Sulphur) as per different texts.

Properties	Rasendra Chudamani [2]	Rasa Ratna Samuchhaya [3]	Raja Nighantu [4]	Kaiya Deva Nighantu [5]	Rasendra Sara Sangraha [6]	Bhavaprakash Nighantu [7]	Ayurveda Prakash [8]
Rasa	Madhura	–	Katu	Katu, Tikta, Kashaya	Madhura	Katu, Tikta, Kashaya	Katu, Tikta
Guna	–	–	–	Sara, Pitta-Janak	–	–	–
Virya	–	Ushna	Ushna	Ushna	Ushna	Ushna	Ushna
Vipaka	Katu, Ushna	–	–	Katu	Katu	Katu	Katu
Karma	Rasayan, Kandu, Kustha, Visarpa, Dadru, Agnideepak, Krimighna	Kustha, Mrityu, Jara, Agnideepak, Virya Vriddhi	Agnikaraka, Kustha, Kandu, Nasaka, Twakaroga Nasaka	Kandu, Visarpa, Kustha, Vata, Kshaya, Pliharoga Nasaka	Rasayan, Kandu, Kustha, Visharpa, Kriminashaka, Pachana	Saraka, Pitta Janaka, Rasayana, Krimi, Visharpa, Kustha, Kshaya Nasaka	Visarpa, Kandu, Krimi, Kshaya, Kapha Vata Nasaka

MATERIAL AND METHOD

Material

- All the raw drugs were procured from the Gola Dinanath market, Varanasi.

Method of Preparation

Preliminary Analysis and Authentication of Raw Ingredients

- All the raw drugs were taken based on their *Grahaya lakshana* from AFI. They were authenticated by subject specialists from the department of *Rasa Shastra and Bhaishajya Kalpana* and Department of *Dravyaguna* of Government PG *Ayurvedic* College and Hospital, Chaukaghat, Varanasi.

Preparation of Gandhaka Ointment

- The reference for the preparation of *Gandhaka* ointment was not directly found in *Samhita* or any other classical text, but according to the similarity of their dosage form, mode of action and appearance, the ointment is closely correlated with *Malahara Kalpana,* which is first mentioned in *Yoga-Ratnakar*.
- Preparation of *Gandhaka* ointment was carried out by referring to the textbook of *Rasatarangini.*

The whole procedure was divided into two,

- Part 1 – Preparation of *Gandhaka Taila* by using *Tila Taila* and *Karanja Taila.*
- Part 2 – Preparation of ointment by adding beeswax to Prepared *Gandhaka Taila.*

PROCEDURE

Part – 1 Preparation of *Gandhaka Taila* by Using *Tila Taila* (GT-TT) and *Karanja Taila* (GT-KT) (R.T. 8)

For the preparation of *Gandhaka* ointment from *Tila Taila*, first take one fresh Markin cloth in a square shape, which has a dimension of 1 "*Aratani*" (distance between the elbow joint and little

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fingertip) (41.91 cm, Approx. 42 cm) from all sides. It is spread out on a clean and flat surface, and over that, the combination of *Shuddha Gandhaka Churna* 48 gm and *Trikatu Churna* 3 gm was evenly blown out.

This cloth is rolled like a taper and tied with a cotton thread on both sides, tail ends, and, in the middle, to avoid the discharge of the powder. This *Varti* was kept deep in "*Tila Taila*" for one *Prahara* (3 hours). Later, the middle part of the *Varti* was held with a "*Sandamsa yantra*", lifted from the *Taila* and burnt from one end. The drops of *Taila* that drip down from burning *Varti* are collected in a vessel placed beneath. This sticky and blackish-dark brownish color *Taila,* was later stored in a suitable airtight container.

Table 4. Therapeutical uses of *Shuddha Gandhaka* as per different texts.

S.N.	Indication	Formulation	Text
1.	Hikka Roganasaka	Gandhaka, Parada Pishti, Tamra Patra	Rasendra-Mangala [9]
2.	Eagle's Eye, like Drishti, Nirogya kaya, Dhirghya ayu	Gandhaka, Triphala Churna, Ghee, Bhringaraja Swarasa, Madhu	Rasaratnasammuchya [10]
3.	Prameha, Prameha Pidika	Gandhaka, Guna, Dugdha	Bhaishajya Ratnavali [11]
4.	a) Naka-Karna-Mukha Roga, Agnimandya	Gandhaka, Triphala Kwatha	Rasatarangini [12]
	b) Nutan Kshaya Roga	Adushakashaya, Gandhaka	
	c) Swash, Kasa	Kantakari Kashaya, Gandhaka	
	d) Twaka Roga	Pakwa-Kadaliphala, Gandhaka	
	e) Daurbalya	Chitraka Mula Churna, Gandhaka	
	f) Arshojanya Guda Vikara	Tila Churna, Gandhaka	
	g) Guda Vikara	Mulethi, Khanda, Sanaya Patti, Saupha	
	h) Kapha Vikara	Gandhaka, Guggulu, Triphala Churna	
	i) Tri Yakshma, Antra Shotha, Gandamala, Netrajyotivardhaka, Viryavardhaka, Sharir Pusti, Manshika Santushti	Malkangani Taila, Vachha Churna, Navneet	
	j) Virya-Shukradosha	Gandhaka, Khanda	
	k) Kandu, Pama	Mridangringa, Shuhaga, Kapur, Gandhaka, Nariyal Taila	
	l) Daha	Shuhaga, Salaki Rala, Sphatika, Gandhaka, Nimbu Rasa	
	m) Bala, Virya, Vridhi	Gandhaka, Mushlali Churna, Dugdha	
	n) Galita Kustha (MahaKustha)	Gandhaka, Madhu, Amla Swarasa	
	o) Amavata, Gridhrasi	Gandhaka Lepa	

For the preparation of the second sample (GT-KT), the same processes again repeated, but *Karanja Taila* was used in place of *Tila Taila.*

Part – 2 Preparation of *Gandhaka* Ointment (GO-TT-GO-KT)

Gandhaka Taila, which is prepared by *Tila Taila* GT-TT, was taken in small vessels, and 1/4th of beeswax was added to it, and then the mixture was prepared by the double-boiling method with continuous stirring.

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Collect and prepare a sample 1st GO-TT in a clean and dry container, send for an analytical parameters test. The same processes were done for sample GT-TT and prepare GO-KT.

DRUG ANALYSIS

All the samples of *Gandhaka* ointment GO-TT and GO-KT were analyzed at Vasu Research Centre, Vadodara, Gujarat.

Precautions During Preparation of *Gandhaka Taila*

- *Gandhaka* should be spread evenly over the cloth.
- *Trikatu* powder should be symmetrically sprinkled over the spread *Gandhaka.*
- Caution should be taken during rolling of *Varti* for leakage of *Gandhaka* mixture.
- *Varti* should be rolled over one-sided.
- After rolling both ends of *Varti* should be folded to prevent the leakage of *Gandhaka* mixture.
- The thread should be tied over *Varti* in a cross form from both sides, and the middle part of *Varti* should give extra clot to prevent the leakage of *Gandhaka* mixture.
- Before immersing the *Varti* vessels should be dry and clean.
- After the end of the immersing time, *Varti* should be gently caught by the *samdamsh yantra* and hung over the immerse vessels for dropping of excess oil, then *Varti* should hang over the iron rod and be ignited.
- During ignition of *Varti*, personal care should be taken.
- During the ignition of *Varti*, precautions should be taken for mixing of ignited particles of *Varti* into *Gandhaka Taila* (For that iron mesh should be put over the vessels).
- Clean and dry small vessels should be used for *Gandhaka Taila* collection.
- During the holding of the *Gandhaka Taila*-filled small vessels on the surface of water, care should be taken to prevent the water from mixing with the *Gandhaka Taila.*
- After mild cooling of the mixture, it should be filled into the container.
- The container should be used and will be dry and clean.

RESULTS

- Results of the pharmaceuticals study (Table 5).
- Results of analytical study (Tables 6–10).

Table 5. Result.

Sample	Amount of *Gandhaka*	Amount of *Trikatu*	Amount of *Tila Taila*	Amount of *Karanja Taila*	Amount of *Ganhdak Taila*	Amount of Bee Wax	Amount of *Gandhaka* Ointment
GO-TT	48GM	3 GM	100 ML	–	32 GM	8 GM	39 GM
GO-KT	48 GM	3 GM	–	100 ML	30 GM	7.5 GM	36 GM

Table 6. Organoleptic characters.

Organoleptic Characters	GO-TT	GO-KT
Color	Dark brown	Dark brown
Odor	Pungent (Burnt Sulphur smell)	Pungent (Burnt Sulphur smell)
Consistency	Semi solid	Semi solid
Uniformity	Uniform	Uniform

Table 7. Physico-chemical analysis.

Parameters	GO-TT	GO-KT
pH (1% Solution)	5.14	4.64
Total Fat	63.17%	38.36%
Loss on Drying	0.18%	0.09%
Assay of Sulphur	38.57%	57.27%

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Table 8. Microbiological analysis.

Name of Microbes	GO-TT	GO-KT	Limit as per API
Total Microbial Plate Count	<10 cfu/gm	<10 cfu/gm	10^5 cfu/g
Total Yeast & Mold Count	Absent	Absent	10^3 cfu/g
Staphylococcus Aureus	Absent	Absent	Absent/g
Salmonella Sp.	Absent	Absent	Absent/g
Pseudomonas Aeruginosa	Absent	Absent	Absent/g
Echerichia Coli	Absent	Absent	Absent/g

PREPARATION OF TEST SOLUTION

Weigh accurately 1 g of sample in a 250 mL reflux flask. To it, add 20 mL of methanol and reflux on a water bath for 15 minutes. On completion of time, remove the reflux flask from the water bath and allow it to cool. Filter with the help of Whatman filter paper no. 1. Then, again filter with the help of a 0.22 µm syringe filter. Use the Test Solution thus obtained for HPTLC fingerprinting.

Preparation of Spray Reagent [5% Sulphuric Acid in Methanol Reagent]

5 mL Sulphuric acid is cautiously mixed with 100 mL Methanol (Figures 1-6).

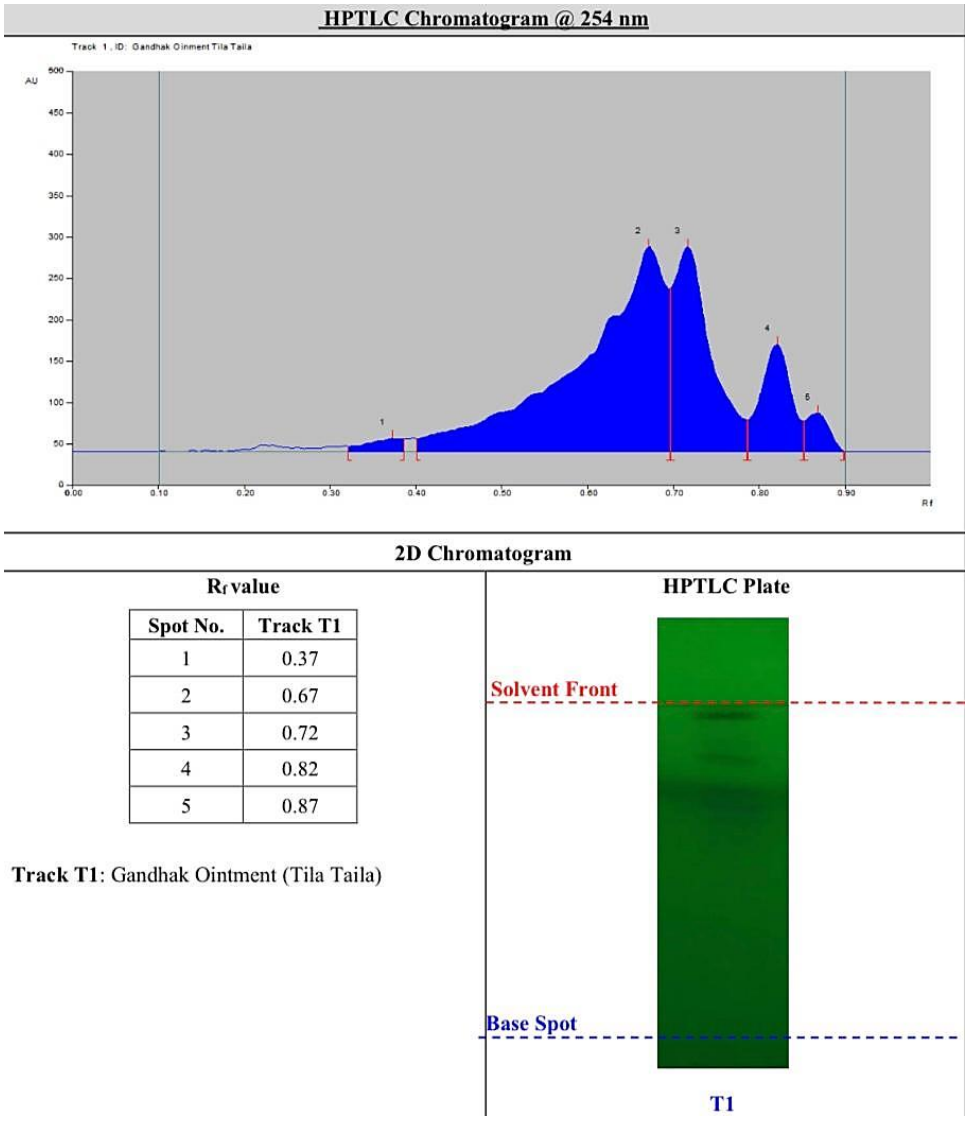

Figure 1. HPTLC for sample GO-TT at 254 nm.

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Table 9. HPTLC test for both ointment samples.

Sample	RF Value on 366 nm Figures 1 & 4	RF Value on 366 nm Figures 2&5	RF Value on 540 nm Figures 3 & 6
GOTT	0.37,0.67,0.72,0.82,0.87	0.62,0.65,0.67,0.72,0.82,0.87	0.23,0.29,0.41,0.51,0.72,0.78,0.82
GOKT	0.37,0.62,0.67,0.82,0.87	0.62,0.67,0.82	0.29,0.41,0.67,0.77,0.82

CHROMATOGRAPHIC CONDITIONS

- Same test done for a sample of GOKT.

Table 10. Comparison of both samples HPTLC.

Application Mode	CAMAG Linomat 5 – Applicator
Filtering System	Whatman filter paper No. 1
Stationary Phase	MERCK – TLC / HPTLC Silica gel 60 F254 on Aluminum sheets
Application (Y axis) Start Position	10 mm
Development End Position	80 mm from the plate base
Sample Application Volume	5.0 µL
Distance Between Tracks	15 mm
Development Mode	CAMAG TLC Twin Trough Chamber
Chamber Saturation Time	30 minutes
Mobile Phase (MP)	Toluene: Ethyl Acetate: Acetic acid (7 2 1 v/v)
Visualization	@ 254 nm, @ 366 nm and @ 540 nm (after derivatization)
Spray reagent	5% Sulphuric acid in Methanol
Derivatization mode	CAMAG – Dip tank for about 1 minute
Drying Mode, Temp. & Time	TLC Plate Heater Preheated at 100± 50C for 3 minutes

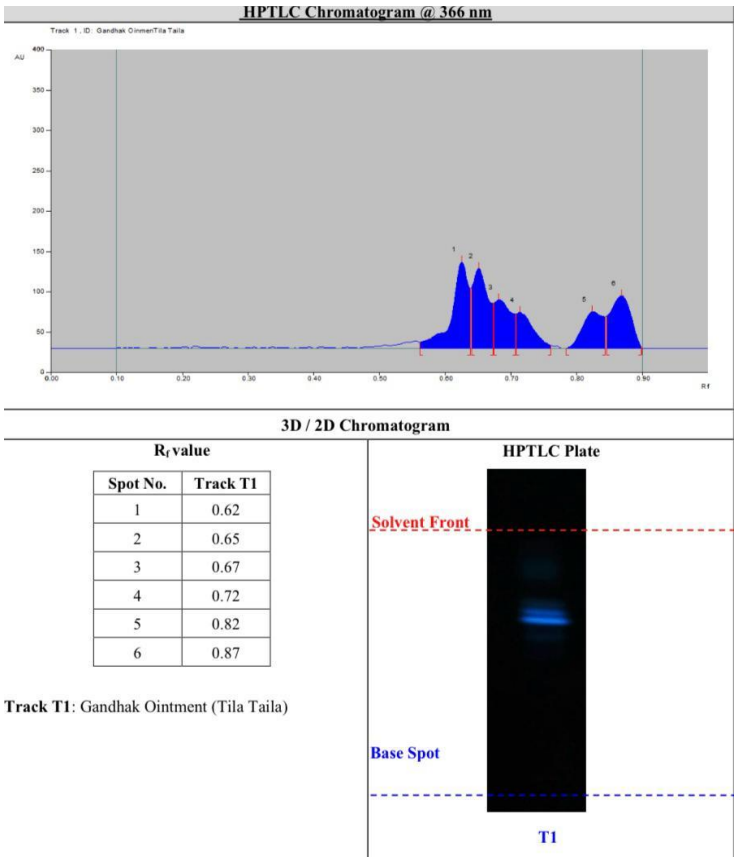

Figure 2. HPTLC for sample GO-TT at 366 nm.

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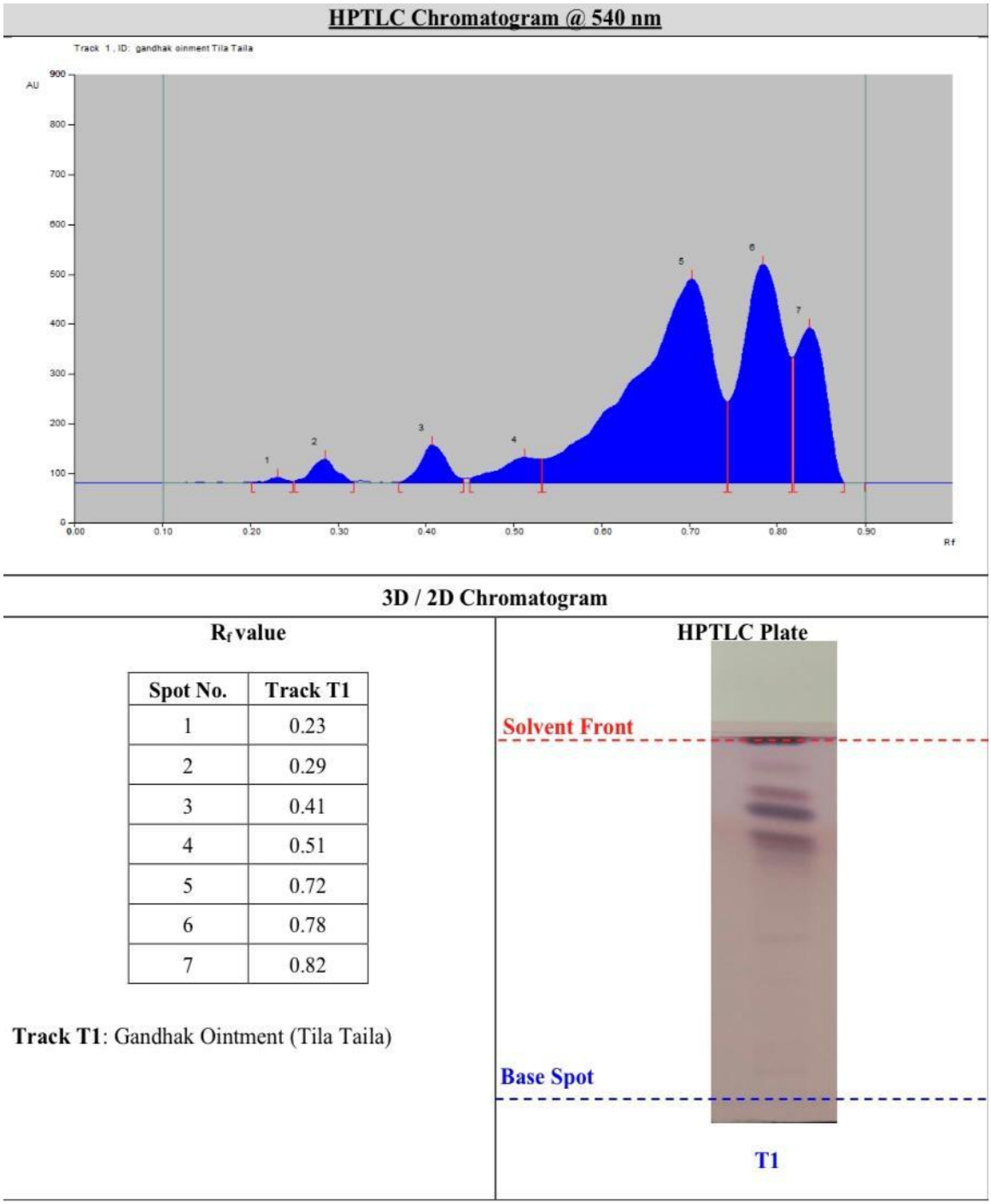

Figure 3. HPTLC for sample GO-TT at 540 nm.

DISCUSSION

Before the preparation of both samples, a few pilot batches were prepared to check and understand the possible difficulties found in the preparation of ointment and to check the ratio of Taila and Beewax, which can be stable in all-weather/seasons. For this study, the ratio of *Shuddha Gandhaka*, *Trikatu* and was taken in an explicit ratio of 1:1/16, and the quantity of *Tila Taila/Karanja Taila* is 100 ml for each *Varti.* The dimension of the cloth is 1 *Aratani* (42 * 42 cm). A mixture of *SHUDDHA Gandhaka* and *Trikatu* is evenly spread over the cloth, and *Varti* is made. Each *Varti* is immersed in *Tila Taila* and *Karanja Taila* for both samples for 3 hours. Average weight of each *Varti:* 64 ± 2 gm. During the ignition, the *Varti* temperature reached approximately 380 ± 4°C for both samples.

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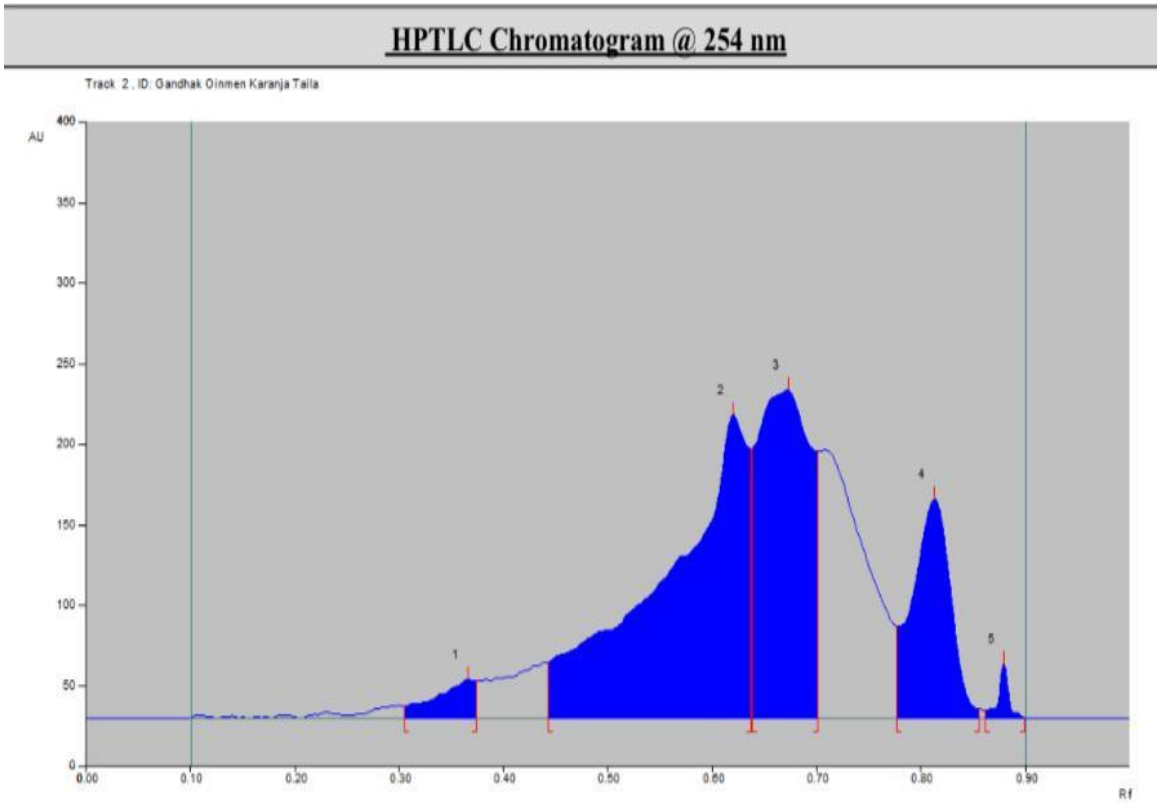

2D Chromatogram

R_f value

Spot No.	Track T1
1	0.37
2	0.62
3	0.67
4	0.82
5	0.87

Track T1: Gandhak Ointment (Karanja Taila)

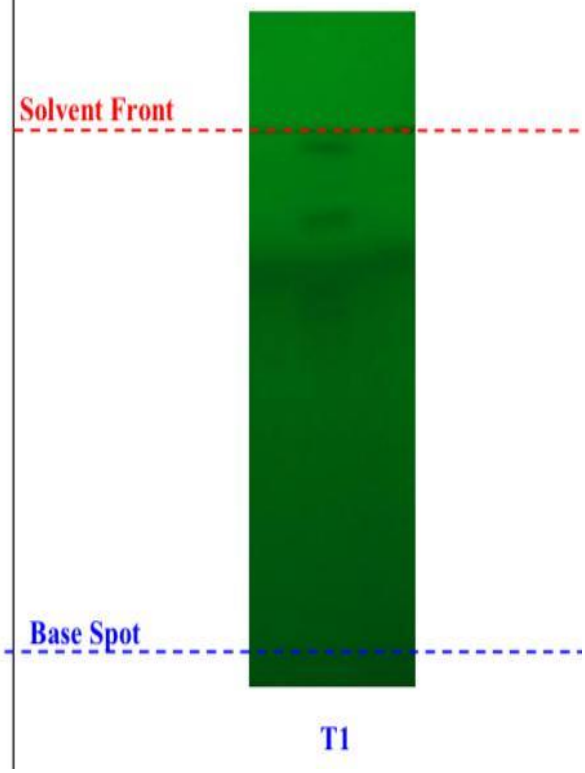

Figure 4. HPTLC for sample GO-KT at 254 nm.

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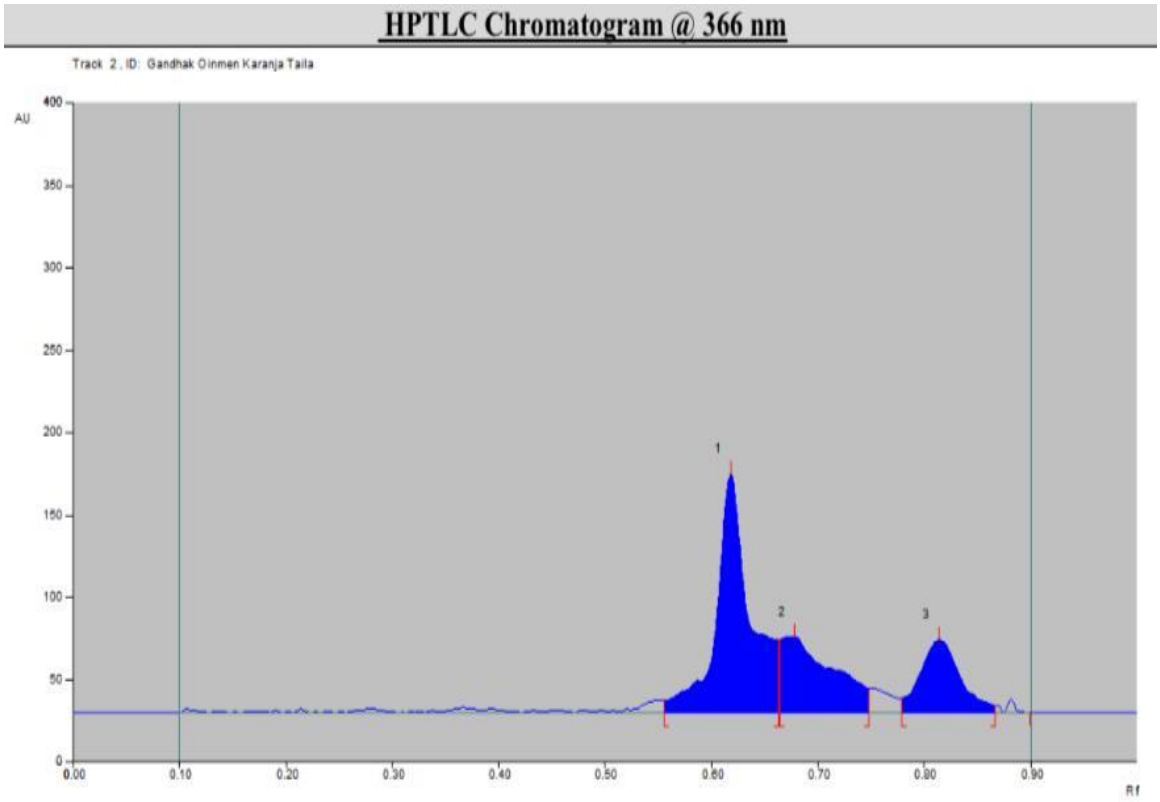

3D / 2D Chromatogram

R_f value

Spot No.	Track T1
1	0.62
2	0.67
3	0.82

Track T1: Gandhak Ointment (Karanja Taila)

Figure 5. HPTLC for sample GO-KT at 366 nm.

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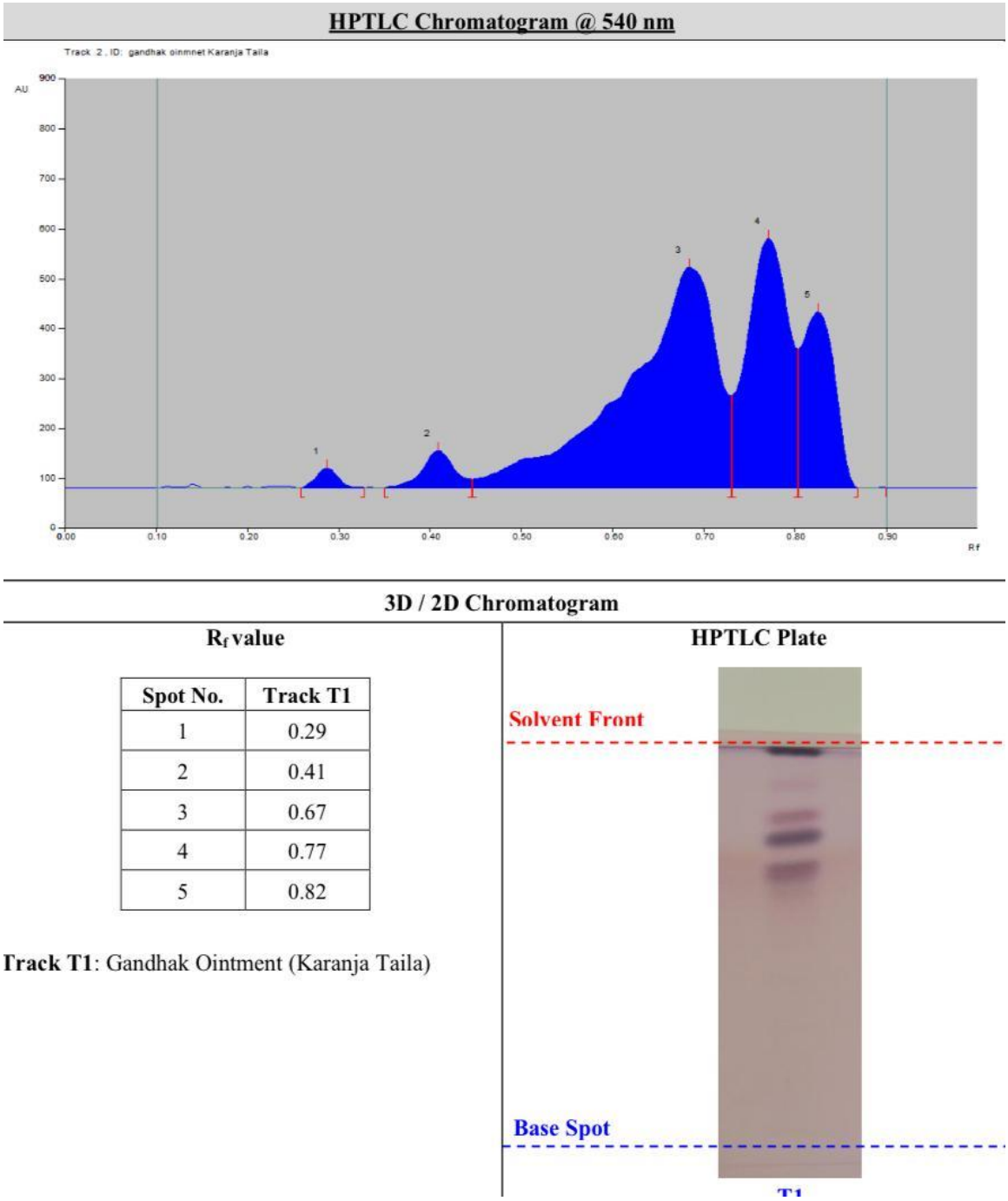

Spot No.	Track T1
1	0.29
2	0.41
3	0.67
4	0.77
5	0.82

Track T1: Gandhak Ointment (Karanja Taila)

Figure 6. HPTLC for sample GO-KT at 540 nm.

The average duration of ignition time is approximately 8–10 minutes for each *Varti.* The average weight of *Gandhaka Taila* from Varti is 30 ± 2 gm. The average weight of solid residue after ignition of each *Varti* is 12 ± 4 g. The Ratio of bee wax: *Gandhaka Taila* is fixed for each sample is 1/4:1 part, respectively.

Organoleptic characters show similarity in taste, odor, color and consistency of the samples.

The pH of both ointment samples was acidic. There is no major difference observed between the pH of GO-TT (5.14) & GO-KT (4.64). The pH of the sample GO-KT is more acidic than the pH of Go-TT. Skin pH is almost like both pHs, so both samples can easily be absorbed through the skin.

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The total fat percentage of the sample GO-TT & GO-KT is 63.17% & 38.36%, respectively. The total fat content of the ointment is responsible for the absorption & moisturizing effect on the affected part. Here total fat content percentage is higher in GO-TT. It was revealed that the sample GO-KT is more absorbable than GO-TT. This preparation is recommended in *Dadru* disease, which is a *Vata* and *Kapha* Predominance disease, so here an ointment is recommended which has a low moisturizing effect.

The total percentage of Sulphur in sample GO-TT & GO-KT is 38.57% & 57.27%, respectively, which reveals that sample GO-KT is more potent than sample GO-TT.

Both Samples Are Uniform

The percentage of loss on drying for samples GO-TT & GO-KT are 0.18% & 0.09%, respectively. Loss on drying gives an estimate of the amount of volatile matter that evaporates when the ointment is dried under specified conditions. Excess moisture can shorten the shelf life and may lead to microbial growth. Here sample GO-KT is better than GO-TT due to a lower loss of drying percentage.

The spreadability of sample GO-TT & GO-KT is 25.90 & 1774.05 g. Spreadability of ointment in grams has four classifications: <200 gm – very good, 200–300 gm – good, 300–400 gm – moderate and >400 gm is poor. According to this criteria sample GO-TT has more spreads than the sample GO-KT. In skin disease, various types of ointments are used; among them, which ointment has good which with lower spreadability, because long-term contact with the skin gives good results.

HPTLC was done at three wavelengths at 256 nm, 366 nm & 540 nm. In Sample GO-TT Track T1 on 540nm shows max spots 07, and sample GO-KT Track T1 on 256 nm & 540 nm shows max spots 05 in both. This suggests that the sample GO-TT has more active constituents than the sample GO-KT.

Microbial growth test for both samples, GO-TT & GO-KT, shows congruence values. In both samples, no microbial growth was spotted.

CONCLUSIONS

The study concluded that the *Gandhaka* ointment prepared with *Karanja Taila* has a higher total Sulphur percentage, lower spreadability, a low percentage of loss on drying, negligible microbial growth, and a pH like the skin. This comprehensive analysis is suitable for skin diseases like *Dadru*, etc. The physicochemical analysis shows minimal comparative difference among the values of the two samples. According to the HPTLC report, sample GO-TT showed a greater number of phytochemical constituents than sample GO-KT.

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